T. A. EDISON.

ELECTRICAL SYSTEM FOR AUTOMOBILES.

APPLICATION FILED MAY 23, 1912.

1,192,400. Patented July 25, 1916.

Fig. 1

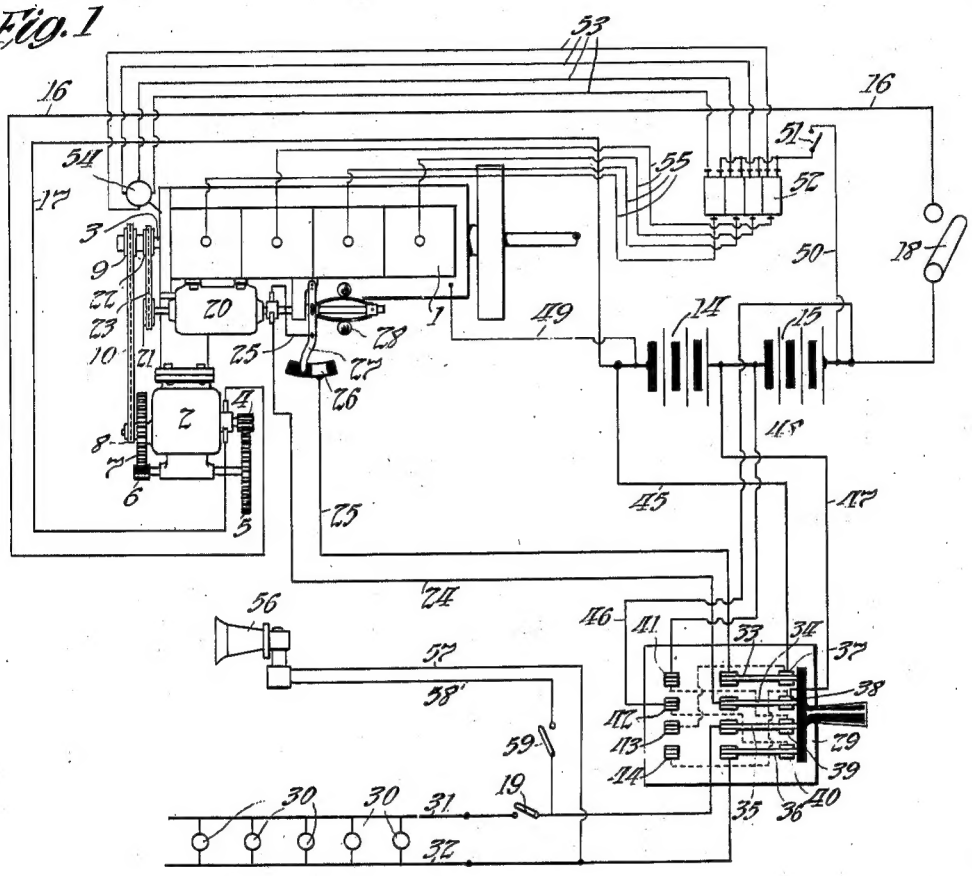
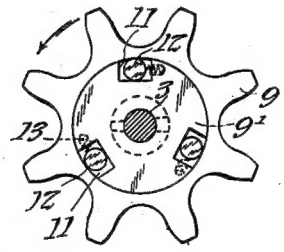


Fig. 2



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UNITED STATES PATENT OFFICE.

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ELECTRICAL SYSTEM FOR AUTOMOBILES.

1,192,400. Specification of Letters Patent. Patented July 25, 1916.

Application filed May 23, 1912. Serial No. 699,110.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex county, New Jersey, have invented a certain new and useful Electrical System for Automobiles, of which the following is a description.

My invention relates to electrical systems for automobiles driven by internal combustion engines. Such engines are not self starting, and I employ an electric motor for cranking or starting the same, a storage battery for operating the motor and for feeding the lighting, ignition, signaling or other circuits of the automobile, and a generator for charging the battery.

The object of my invention is to provide a simple and efficient system for this purpose in which a small number of battery cells may be advantageously employed in such a manner that the entire battery is available to supply current for the starting motor, and in which the lamps are not subjected to changes in voltage due to variations in speed of the generator.

In my improved system, uniformity of illumination of the lamps is obtained, and the life of the lamps is prolonged.

Other objects will appear in the further description of my invention, in which reference is had to the drawings accompanying and forming part of this specification, and in which—

Figure 1 is a diagrammatic view of one embodiment of my improved system; and Fig. 2 is a view of a declutching device suitable for use in my improved system.

My improved system is suitably mounted upon an automobile and in its preferred form includes the following apparatus:—At 1 is shown an internal combustion engine for driving the automobile, which engine may be of any suitable form, such as a gasolene engine, and I have illustrated it as a four cylinder engine, and at 2 is shown an electric motor for cranking or starting the engine. The motor 2 is operatively connected to the crank shaft 3 of the engine 1 in any suitably manner, and preferably through greatly reduced gearing, and by means permitting the motor to be unclutched from the crank shaft of the engine after the engine has gotten up to speed. In the drawings I have shown the motor 2 connected to the crank shaft of the engine 1 by means of a small gear wheel 4 fixed on the motor armature shaft and meshing with a large gear wheel 5, a small gear wheel 6 being fixed on the shaft of the gear wheel 5 and meshing with a large gear wheel 7, the gear wheel 7 being provided with a small sprocket wheel 8 which drives a chain 10 engaging the sprocket wheel 9 which is declutchably connected to the crank shaft 3 of the engine. In this manner I secure a large reduction in speed from the motor 2 to the crank shaft of the engine, and am enabled to use a small power motor to start the engine. In the particular form of declutching device which I have illustrated in Fig. 2, a collar 9′ is secured to the crank shaft 3 of the engine, and upon the collar the sprocket wheel 9 is rotatably mounted. The collar 9′ is provided with openings 11 adjacent to the inside of the sprocket. In each of the openings 11 and between the collar and the inside of the sprocket, cylinders or balls 12 are located, which are adapted to be wedged between the collar and the sprocket when the sprocket is rotated in the direction indicated by the arrow, that is, the direction in which it is driven by the motor 2 through the chain 10 to crank the engine. By this means, the sprocket is clutched to the crank shaft of the engine while the engine is being started by the motor.

When the speed of the crank shaft exceeds the speed of the motor-driven sprocket 9 the cylinders or balls 12 are moved out of clutching position, and the sprocket 9 unclutched from the crank shaft. The cylinders or balls 12 are pressed by light springs 13 into positions from which they may be easily moved into clutching position. The motor 2 is connected in series with a storage battery divided into two sections 14 and 15, each containing the same number of storage battery cells, by means of conductors 16 and 17. The two battery sections 14 and 15 are connected in series. In either of these conductors, as for example conductor 16, a switch 18 is provided for connecting and disconnecting the motor 2 from the storage battery. The entire storage battery is therefore available for operating the motor to start the engine.

At 20 is shown a generator connected to the crank shaft 3 of the engine 1 by any suitable means, as for example, by a sprocket 21 on the armature shaft of the generator, a sprocket 22 on the crank shaft 3 of the en-

gine, and a chain 23 connecting the sprockets. The generator 20 is provided with two leads 24 and 25 from the brushes, which are connected to a switching device 29 for connecting the said leads to either of the battery sections 14 or 15. In either of the leads 24 or 25 an automatic switch is provided for interrupting the generator circuit when the generator is at rest or is operating below a predetermined speed, for making the said circuit when the speed reaches or exceeds the said predetermined limit, and maintaining it closed until a still higher predetermined speed limit is reached, and for interrupting the said circuit when the speed exceeds the higher predetermined limit. For this purpose I have illustrated a fixed contact 26 and a movable contact 27 coöperating therewith, both of said contacts being connected in the lead 25. The movable contact 27 is operated by the centrifugal governor 28 which is mounted on the armature shaft of the generator 20 or otherwise suitably connected thereto. The movable contact 27 coöperates with the fixed contact 26 to make the circuit of the lead 25 between predetermined speed limits only, the lower limit being so chosen as to prevent the battery section to which the generator is then connected from discharging back through the generator, and the higher limit being so chosen as to prevent an excessive voltage being impressed on the battery section terminals.

At 30 are shown electric lamps connected across conductors 31 and 32. In either of these conductors, as for example, conductor 31, a switch 19 is provided for controlling the lamp circuit. The switching device 29 serves to connect interchangeably the generator 20 to one battery section and the lamps 30 to the other battery section. The particular form of switching device 29 which I have illustrated consists of switch blades 33, 34, 35 and 36 adapted to coöperate with contacts 37, 38, 39 and 40 respectively for the right hand position of the switch, and to coöperate with contacts 41, 42, 43 and 44 respectively for the left hand position of the switch. Contact 37 is electrically connected with 43, 38 with 44, 39 with 41, and 40 with 42. All of the switch contacts are mounted upon an insulating block in the usual manner, and all of the switch blades are pivoted at one end on the block and provided with a common insulating handle at the other end. Switch blades 33 and 34 are connected to the leads 25 and 24 respectively, from the generator, and switch blades 35 and 36 are connected to the conductors 31 and 32 respectively leading from the lamps. The contact 37 is connected to one extreme terminal of the battery by conductor 45, contact 42 is connected to the other extreme terminal of the battery by conductor 46, and the contacts 38 and 41 are connected to the middle point of the battery by means of the conductors 47 and 48 respectively. The battery section 14 is thus connected across the contacts 37 and 38 and the battery section 15 is connected across the contacts 41 and 42. The switching device has three positions: first, a neutral or open position; second, a right hand closed position in which the generator 20 is connected to section 14 of the battery and the lamps 30 are connected to section 15 of the battery; third, a left hand closed position in which the generator 20 is connected to section 15 of the battery and the lamps 30 are connected to section 14 of the battery. An ignition system is connected across conductors 49 and 50, which are connected to suitable points on the battery, as for example, to the extreme terminals of the same. In either of the conductors 49 and 50, as for example, in the conductor 50, a switch 51 is provided for controlling the ignition circuit. The conductor 49 is grounded on the engine, and the conductor 50 leads through the switch 51 to induction coils 52 which are provided with leads 53 connecting with a timer 54 and leads 55 connecting with the spark plugs of the engine cylinders.

I may also operate signals or other electrical devices from the battery or from a section of the same. I have illustrated a signal device such as a Klaxon horn 56 connected across the lighting circuit 31, 32 between the switch 19 and the switch 29 by means of conductors 57 and 58. A switch 59 is provided in the conductor 58 for controlling the signal.

As is well known, the voltage of a storage battery decreases as the battery passes from fully charged condition to discharged condition, and I prefer to use lamps, the normal operating voltage of which is higher than the average voltage of either battery section. The reason for this choice of lamps will appear hereinafter.

The operation of my improved system is as follows:—In Fig. 1 the motor starting switch 18, the ignition circuit switch 51 and the lamp circuit switch 19 are all shown in open position, and the engine and automobile are at rest. To start the engine the ignition switch 51 is closed first, the motor starting switch 18 is then closed and the motor is started up, being supplied with current by the two battery sections 14 and 15 in series with each other. If lights are desired, the switch 19 is closed, and the switch 29 may be in either of its closed positions. The motor 2 starts up the engine 1, and when the engine begins to operate under its own power and reaches a predetermined speed the motor is automatically unclutched from the engine by the declutching device and the motor starting switch is opened. When the

generator 20 driven by the engine attains a predetermined speed, the contacts 26, 27 are closed, and current is supplied from the generator 20 to one or the other of the battery sections 14 or 15 to charge the same, and at the same time current is supplied from the other battery section to the lamp circuit 31, 32. When the switch 29 is in its right hand closed position, as is shown in Fig. 1, the circuits may be traced as follows:—First, the charging circuit: starting at the generator 20, through lead 24, switch blade 34, switch contact 38, conductor 47, battery section 14, conductor 45, switch contact 37, switch blade 33, conductor 25, through closed contacts 26 and 27, and back to the generator. Second, the lighting circuit: starting at battery section 15, through conductor 46, switch contact 42, switch contact 40, switch blade 36, conductor 32, lamps 30, conductor 31, including switch 19, switch blade 35, switch contact 39, switch contact 41, through conductor 48 and back to the other terminal of the battery section 15. For the left hand closed position of the switch 29, the circuits may be traced in a similar manner, and in such position the battery section 15 is connected to the generator 20 and the battery section 14 to the lamps 30.

In my improved system, I am enabled to utilize the entire battery voltage for operating a starting motor, and at the same time am enabled to charge one section of the battery while another section is being used to feed the lamps, and in this manner I secure a substantially constant voltage upon the lamps while the battery is being charged from the generator, for which it is not necessary to provide special regulating means.

I prefer to use lamps which have a voltage considerably higher than the average voltage of a battery section in discharging, so that the operator, in order to obtain a proper degree of illumination of the lamps, will be caused to shift the switch 29 at intervals, thereby preventing any considerable variation in the degree of illumination of the lamps, and insuring keeping the battery in a high condition of charge. The life of the lamps is prolonged because they are fed with current of substantially constant voltage, and are not subjected to the injurious effects of varying voltages.

Having now described my invention, what I claim and desire to protect by Letters Patent is as follows:—

1. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating said motor, substantially all of said battery being available for supplying current to said motor to start the engine, a generator arranged to be driven by said engine, a lighting circuit, and means for connecting said generator and lighting circuit to different sections of the battery, substantially as described.

2. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating the motor, a generator arranged to be driven by said engine, means for connecting said battery to said motor independently of said generator, a lighting circuit, and means for interchangeably connecting said generator and lighting circuit to different sections of the battery, substantially as described.

3. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating the motor, an ignition system for the engine connected to be supplied from the battery, a generator arranged to be driven by said engine, means for connecting said battery to said motor independently of said generator, a lighting circuit, and means for interchangeably connecting said generator and lighting circuit to different sections of the battery, substantially as described.

4. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating the motor, a generator arranged to be driven by said engine, means for connecting said battery to said motor independently of said generator, a lighting circuit, and a switch for connecting said generator and lighting circuit to different sections of the battery, substantially as described.

5. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating the motor, a generator arranged to be driven by said engine, means for connecting said battery to said motor independently of said generator, a lighting circuit, and a switch for interchangeably connecting said generator and lighting circuit to different sections of the battery, substantially as described.

6. In a system of the class described, an internal combustion engine, an electric motor declutchably geared thereto for starting the same, a storage battery for operating the motor, a generator arranged to be driven by said engine, a lighting circuit, and a switch for interchangeably connecting said generator and lighting circuit to different sections of the battery, substantially as described.

7. In a system of the class described, an internal combustion engine, an electric motor declutchably geared thereto for starting the same, a storage battery for operating the motor, an ignition system for the engine connected to be supplied from the battery, a generator arranged to be driven by said engine, a lighting circuit, and a switch for in-

terchangeably connecting said generator and lighting circuit to different sections of the battery, substantially as described.

8. In a system of the class described, an internal combustion engine, an electric motor for starting the same, a storage battery for operating said motor, substantially all of said battery being available for supplying current to said motor to start the engine, a generator arranged to be driven by said engine, a circuit containing electrical devices, and means for connecting said generator and said circuit to different sections of the battery, substantially as described.

9. In a system of the class described, an automobile having an internal combustion engine for driving the same, a motor for starting the engine, a storage battery comprising two sections each consisting of the same number of cells, a generator, lamps, and connections for permitting all of said battery to supply current to the starting motor when desired, and for causing one section of said battery to be charged from the generator, while the other section is supplying current to the lamps, substantially as described.

10. In a system of the class described, an internal combustion engine, a motor for starting the engine, a storage battery consisting of two equal sections, a generator arranged to be driven by said engine, a lamp of normal voltage greater than the average voltage of one of said battery sections, and connections for permitting all of said battery to supply current to the starting motor when desired, and for causing one section of said battery to be charged from said generator while the other section is supplying current to said lamp, substantially as described.

11. In a system of the class described, an internal combustion engine, an electric motor declutchably geared thereto for starting the same, a storage battery for operating said motor, all of said battery being available for supplying current to said motor to start the engine, a generator arranged to be driven by said engine, a circuit containing translating devices, and means for interchangeably connecting said circuit and said generator to different sections of the battery, said generator connection being established only for generator speeds between predetermined limits, substantially as described.

This specification signed and witnessed this 20th day of May, 1912.

THOS. A. EDISON.

Witnesses:
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